Eelgrass Restoration Project Update-3-4-2005

Eelgrass Restoration Project efforts during 2004 focused on three major tasks: site selection, permitting, and planning for the spring '05 field season.

Site selection:
The task of selecting potential transplant areas in Boston Harbor involved the collation and evaluation of available Boston area environmental data sets which were acquired from various agencies and augmenting these data with in situ environmental monitoring. Our MassGIS-based model, which computes a preliminary transplant suitability index (PTSI) from a suite of physical and biological parameters, effectively focuses the search for suitable sites thus reducing the number of areas targeted for further investigation.

The model assigns a score ranging from 0-2 to each parameter's values, with 2 being the most suitable for eelgrass growth. The analysis is multiplicative; i.e., the values assigned to each of the parameters at a specific site are multiplied by one another. Thus any parameter with a value of zero (0) will result in a site index value of zero (0) and eliminate the site from further consideration, while high final scores make it tentatively acceptable.

Scores are based on values from the literature and also from existing local reference eelgrass beds. During 2004, Eelgrass Project personnel initiated environmental monitoring activities in the Boston Harbor area to augment available historical data. Each of the four existing beds in Boston Harbor, located with 2001 DEP Wetlands Conservancy flyover data, were examined for depth, salinity, water temperature, light attenuation, and sediment type. In addition, NE exposure (prevailing direction of winter storm winds) was measured on the MassGIS map. These data were incorporated into the model along with information from the literature to obtain values for PTSI scores. MassGIS model output was thus refined with pertinent water quality data, and through analysis of existing eelgrass beds, the model's input parameters were adjusted to more accurately reflect local eelgrass conditions. Shoot density was taken at most of the existing beds. Three (3) existing beds north of the Harbor, between Nahant and Revere were also examined. Data indicate that Nahant and Revere beds have excellent potential as donor sites. Table 1 details the PTSI scoring criteria and data sources which were used in constructing the model.

Table 1. PTSI scoring criteria for parameters used in evaluation of site suitability for eelgrass (*Zostera marina*) transplanting.

Parameter	PTSI score	GIS Data Source	Groundtruthing method
Depth	0 = <0.5m or > 4m 1 = 3 - 4m 2 = 0.5 - 3m	NOAA Navigational Chart: values based on reference beds	Depth soundings adjusted to low tide
Exposure	0 = NE fetch > 2724 1 = 1866 to 2274 m 2 = < 1866 m (average of existing beds	*MarineFisheries:* calculation from exisiting beds	Visual: protection from NE
Historical SAV distribution	0 = not used due to incomplete data 1 = previously vegetated in 1 survey 2 = previously vegetated in 2 or more surveys	Mass DEP Wetlands Conservancy Program (WCP): Historical eelgrass distribution (1951, 1971, 1995) and current eelgrass distribution (2001)	Visual inspection with SCUBA
Current SAV distribution	0 = currently vegetated 2 = unvegetated	Mass DEP Wetlands Conservancy Program (WCP) Historical eelgrass distribution (1951, 1971, 1995) and current eelgrass distribution (2001)	Visual inspection with SCUBA
Water Quality	0 = >1 WQ value does not meet eelgrass requirements* 1 = meet all but one 2 = meet all requirements	MWRA BHWQM, CSORWM projects	Light attentuation measured with LICOR 1400 data logger
Bioturbation	0 => 1 crab/m2 1 = 1 crab/m2 2= <1 crab/m2	none figures based on Davis et al. 1998	50m sweep with 2m swath bar, counting crabs and skates/rays in each 10m segment

Sixteen (16) sites were originally identified with the PTSI output (Figure 1). Most potential transplant sites were surveyed allowing the prioritization of sites and the elimination of many others. Six sites were eliminated due to presence of a marina, high energy environment, or incorrect depth, i.e., too shallow or too deep. The boat traffic associated with marinas makes transplanting impractical and potentially dangerous. Riprap reflects the wakes generated in shipping channels, creating energetic conditions unsuitable for eelgrass growth. The monitoring of potential sites will continue in spring ’05.

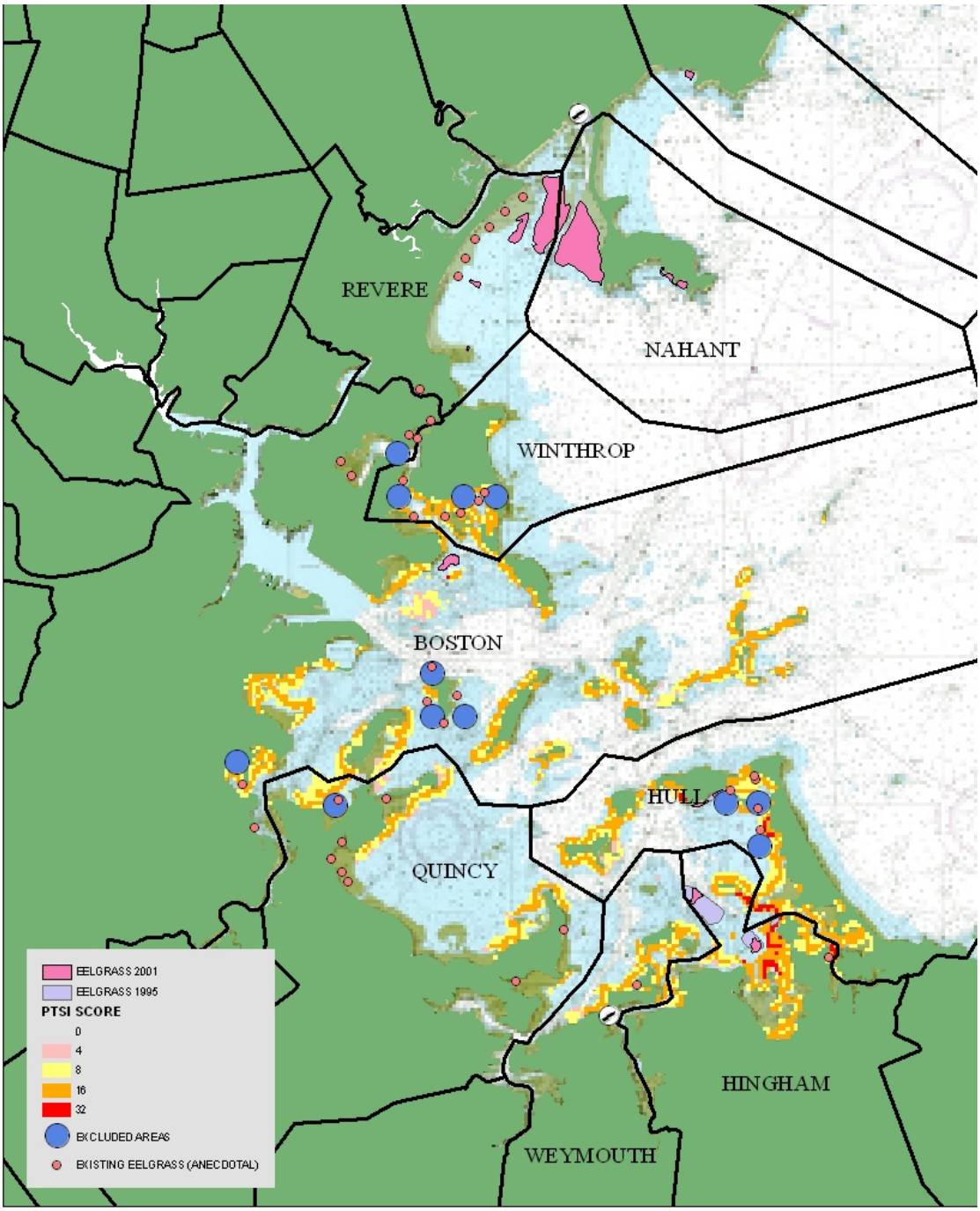

Figure 1. Potential eelgrass transplant sites in Boston Harbor. PTSI = Preliminary Transplant Suitability Index. Areas with higher scores will be investigated further for suitability and final sites will be selected based on test transplant success. Blue circles cover areas that have been eliminated after initial field testing for various reasons e.g., presence of a marina, inadequate depth, high traffic areas, etc. Existing eelgrass beds in Revere and Nahant represent potential donor sites.

Sites that scored well on the PTSI index received "groundtruthing." Field protocols were developed for this task, including depth adjusted for tides, sediment type, and bioturbator (i.e., animals detrimental to eelgrass) density. Procedures for taking, storing, and processing sediment core samples were defined (Figure 2). Sediment cores were collected and bioturbators such as green crabs and skates were counted along 2 to 3, 50m transects per site (2m swath per transect). Sediment samples were dried and sieved to determine composition by grain size and associated weight.

Figure 2. Collecting sediment cores in Boston Harbor.

Sediment grain size obtained at many sites was very fine (silt and clay) with black anaerobic mud below ~2 cm. These observations of possible anoxic sediments in some areas raised concerns about bottom sediment quality. Anoxic sediment can subject eelgrass to H_2S toxicity. As a result, contracted analyses of total organic carbon (TOC) and pore water sulfide were planned to help refine the transplant site selection process. Laboratories which conduct these analyses were researched and services were contracted for the task which will begin in spring '05.

Permitting:

Considerable time was spent on researching eelgrass restoration permit requirements with other agencies and filling out appropriate forms for submission. All necessary permits have been filed and are in process including Notices of Intent with the seven (7) affected towns and DEP. A Power Point presentation on our Eelgrass Restoration work was constructed for communication to Town Conservation Commissions during our Notice of Intent hearings. To date, presentations have been made at five (5) Town Conservation Commissions, with the other two scheduled in the next month. Permits have also been filed with the Army Corps of Engineers, the Massachusetts Historical Commission, and Board of Underwater Archeological Resources. Conditional approval was issued for our project by the Massachusetts Historical Commission. Formal approval is pending the communication of our final transplant sites.

Planning for spring '05 field season:

Data collected in the fall have facilitated planning of the spring field season. The scheduling of 2005 field work was defined including vessel and truck needs. Prototypes of possible TERF alternatives were developed and will be tested in the field. Wire mesh TERFs can be cumbersome and heavy because they are weighted down with bricks for balast. Simple, lightweight alternatives, e.g., a square PVC tube frame, with open elbow fittings at the corners which allow it to fill up with water for balast when submerged may be advantageous. These frames would have biodegradable twine attached in a checkerboard pattern to which eelgrass shoots would be tied at each junction with rhizomes in contact with the sediment.

One new restoration technique is being considered for our work plan. The possibility of co-planting eelgrass with oysters was researched and the feasibility of a transplant was discussed with *MarineFisheries* staff. Oysters would help to reduce siltation which has become problemsome in the degraded Boston Harbor environment. This technique has been deployed in Chesapeake Bay and may benefit our effort. Further research on oyster filtration rates and their effect on water clarity is on-going.

As weather improves, sediment cores will be collected for carbon and sulfide analysis. Also, PTSI site groundtruthing initiated in the fall will be continued. It is hoped that ~ten (10) sites suitable for test transplanting will be defined. Later in the spring (May/June) the harvesting at donor beds will begin, followed by planting at the test sites. *MarineFisheries* will be recruiting a volunteer work force for these tasks.

Efforts to organize the outreach segment of the Eelgrass Restoration Project are underway. Volunteer assistance is an important means by which we can generate a sense of awareness about this valuable resource and involve the community in its restoration and protection. Participation in eelgrass restoration by local citizens is welcomed, not only for the practical help it provides, but to create a sense of ownership and stewardship among participants that will help ensure the long-term subsistence of this important resource. *MarineFisheries* staff have had contact and met with several Boston area high school teachers and officials to discuss ways of teaching students about the project and providing students an opportunity for active participation. We are also in touch with dive clubs, and several watershed associations and citizens groups concerned with the Harbor in an attempt to inform and involve their memberships. This Project will provide a "hands-on" educational experience for members of the community.